ART. IV.—SOME PECULIARITIES IN THE MYELINE OF PERIPHERAL NERVES AFTER TREATMENT BY OSMIC ACID.

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SINCE the time of Schwann, it has been known that the structure of the peripheral nerves was, first, an external sheath of connective tissue—the sheath of Schwann; second, a tube of fatty phosphorized material, the white substance of Schwann, or myeline, inside of which is placed the axis cylinder. Our present knowledge of the histology of nerves dates from 1872, when Ranvier, of Paris, made a re-investigation into their structure, using osmic acid for his observations.

The osmic acid stains the myeline of a deep black color, leaving the axis cylinder unstained, and this, in turn, can be stained with carmine.

By this method, Ranvier showed that the myeline is not one continuous tube, enclosing the axis cylinder from its origin to its termination, as had been previously believed, but that at every two millimetres of the nerve there was a constriction on the myeline (see cut, Fig. 2) down to the axis cylinder. These constrictions are now known as the constrictions of Ranvier.

In nerves taken directly from living animals and examined in serum and without staining material, these constrictions of Ranvier are seen very distinctly.

Prof. J. C. Dalton, in the edition of his physiology in 1866, gives a very accurate representation of these constrictions, but

distinctly states that they are accidental breaks in the myeline, and it was reserved for Ranvier, in 1872, to announce their true character.

In December, 1876, whilst working in the Neurological Department of the School of Histology in this city, (New York) under the direction of Prof. E. C. Seguin, I observed that fresh nerves of the dog treated by osmic acid, showed some peculiar appearances in the myeline (see cut, Fig. 3).

EXPLANATION OF CUT:

Sciatic nerve of frog treated in situ.

1. Sheath of Schwann. 2. Constriction of Ranvier. 3. Fissures in the myeline as observed by me.

I have since examined the nerves of the frog, mouse and man (nerves taken immediately from an amputated lower extremity, given me by Dr. Seguin), and find that these peculiar markings are present in the myeline of each. The markings are seen best in the nerves of the frog and dog, and are to be seen very distinctly in man, less so in the mouse.

The method adopted is as follows: The nerve is taken with the greatest possible rapidity from the animal and placed in a watch glass containing 1 per cent. solution osmic acid, allowed to remain 20 minutes, washed well in water and placed in glycerine. Small portions of the nerve are then teased and mounted in glycerine.

Some of my observations have been made on nerves treated in situ in the living animal; this is doubtless painful. As the acid is very irritating, and having a great repugnance to inflicting pain on animals, I chloroformed my frogs, under the influence of which they come very rapidly. Just before they become motionless, they make a few of what appear to be efforts at vomiting.

Injection of chloral would doubtless do as well.

In nerves treated as above indicated, the markings in the myeline are to be seen with great distinctness. My reason for treating the nerve in situ was this: I found that the nerves

taken from the animal some time after death did not show the fissures, and that the nearer living the nerve is when it is submitted to the action of the acid the better the fissures show.

The fissures, however, can be seen very distinctly on nerves taken *very rapidly* from the animal and placed in the acid, and it is not necessary to treat them in situ. Care should be taken not to injure the nerves whilst removing them, so as to get as few breaks in the myeline as possible.

The regularity with which these fissures in the myeline occur is so striking that one is led to believe that he has discovered something new in the histology of nerves. Are these artificial productions, or are they normal? The following facts would incline one to believe them to be normal. The fissures are on both sides of the axis cylinder, at precisely opposite points, and the edges of the mycline in the fissures are sharply defined, as if cut across and not torn.

But on the other hand, it is to be observed that these fissures do not occur at regular intervals all through a nerve. In some parts the fissures are very near each other, and at other places much further apart. Then the fissures do not all run in the same direction (see plate). These latter reasons lead me to believe that they are artificial.

If these are artificial, how are they produced?

Ordinarily in examining nerves, it is observed that the myeline presents a serpentine appearance, which is most apparent along its outer edge. In nerves treated as above this serpentine appearance is wanting.

I believe that the osmic acid affects the myeline so rapidly that it is thoroughly saturated and stained before coagulation takes place, and that the myeline is to a certain extent rendered firm by the astringent properties of the acid, and as coagulation progresses the myeline contracts, just as all albuminoid substances contract under the action of an astringent, and thus these fissures are formed in the myeline. I speak of these as fissures, for I think it indicates better the smooth regular edges of the openings. And there are to be seen besides what we have been in the habit of speaking of as breaks in the myeline, and which are produced by force in the teasing of the preparation, while these fissures are not so produced.